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ABSTRACT

This paper discusses how a native English-speaking scientist should write and how they actually write scientific articles. This is complemented by considering the aspects of English that journal editors reported as influencing their assessment of manuscripts submitted by second language authors. Some of the ways in which native language and culture affect these aspects, with special reference to the discourse and rhetoric of science writing, are indicated. This is illustrated in relation to Dutch and Spanish writing. Non-native speakers of English can more easily adopt the norms of English science writing if they understand where their native writing culture is positioned in relation to the English writing culture. (Contains 41 references.) (KFT)

Writing science like an English native speaker: how far can and should non-native speakers of English go?

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Writing science like an English native speaker: how far can and should non-native speakers of English go?

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Abstract
A discussion of how English native speaking scientists should write and how they actually write reveals one of the constraints to how far a non-native speaker of English will go when writing scientific articles. This is complemented by considering aspects of English that journal editors have reported as influencing their assessment of manuscripts submitted by second-language authors. I indicate some of the ways native language and culture affect these aspects, with special reference to discourse and rhetoric in science writing. This is illustrated in relation to Dutch and Spanish writing. I argue that non-native speakers of English can more easily adopt the norms of English science writing if they understand where their native writing culture is positioned in relation to English writing culture.

Introduction

I chose to speak on this question because it has been lurking at the back of my mind during the over 20 years that I have been working as a freelance authors' editor for Dutch scientists. It is related to the more personal question that authors' editors and translators often ask themselves, which is 'How far should I go to get this author's text to look, sound and read like a native speaker's text?' It is only since embarking on PhD research on the acceptability of the English written by Dutch scientists that I have been able to see how both these questions might be answered. The insight I've obtained from reading the literature on composition research, contrastive rhetoric, English for special purposes and learner English has put my practical experience into perspective. I'd like to share the resulting synthesis of practical experience and theory with you. Although my second-language (L2) scientist-writers are Dutch and yours are Spanish, I think there are similarities in the problems they face when they write in English. But there must also be differences, and I will suggest what these might be. I must stress, however, that my knowledge of Spanish and of Spanish writing culture is second-hand; I am looking forward to your comments, so that I can adjust my ideas if necessary.

I propose to begin by discussing English-native-speaker science writing. I'll mention the problems encountered in texts written by English native speaking scientists and then look at the problems encountered by L2 authors. This leads into a discussion of the role of culture in writing. I aim to show that it is important for an author to attune his or her writing to the target culture and to suggest ways that teachers, editors and translators can help in this.

The writing of English native speaking scientists

Perhaps the best way of finding out how English native speaking scientists do *not* generally write is to look at the textbooks written for these authors. I have listed some

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in the references to this paper. Whether written by British (Albert, 1997; Booth, 1984; Kirkman, 1992; O'Connor, 1991), Australian (Lindsay, 1995) or American (Alley, 1996; Day, 1994, 1995; Huth, 1990; Matthews et al. 1996) authors, the recommendations are similar (see box 1). The problems they address arise because few scientists are gifted writers. They write because they have to, rather than because they like to. They also write to impress their colleagues. The result is that the characteristic features of scientific English, as identified by text analysis (e.g. Bazerman & Paradis, 1991; Biber, 1988) obstruct rather than aid readability (see box 2).

Box 1: General recommendations for writing 'scientific English'
(The ideal)

- use short sentences
- when possible, write in the active voice rather than the passive
- avoid unnecessary jargon and long words
- avoid using noun clusters and stacked modifiers
- write concisely (no pointless words and phrases)
- write precisely (use correct terms, be specific)

Box 2: Characteristics of scientific English
(Reality!)

- complex sentences
- frequent use of passive constructions
- plenty of nominalisations
- jargon
- noun clusters and stacked modifiers

Anyone who has had to review or edit L1 (native speaker) English science texts is well aware of the reader-unfriendliness of much of the writing. Small wonder that journal editors, who combine scientific acumen with a feel for language and writing, are driven to pleading with their authors to write more readably (Anonymous, 1996; Gregory, 1992; Webster, 1990). Reviewers, journal editors and copyeditors do attempt to make texts more readable (e.g. by simplifying sentences, converting passive constructions into active ones, untangling noun clusters: O'Connor, 1978; Page et al., 1997), but constraints of time, money, will and perhaps even the lack of editorial skill allow many L1 scientific texts to be published in reader-unfriendly English. This creates a vicious circle: publishing L1 English that is full of features of 'scientific English' provides an example to novice scientist-authors, who therefore assume that the way to get published is to emulate this style, so they then do so. Interestingly, they do so even though they recognise that the English they write is not reader-friendly. This has been elegantly demonstrated by John Kirkman, an independent British consultant and teacher of scientific and technical writing. He uses various versions of an English science text, ranging from one written in the first person, with short sentences lots of active verbs, to one written in the passive voice,

with long sentences, plenty of nominalisations, jargon etc., to make scientist-authors aware of their paradoxical desire to read direct, uncomplicated prose but to write dense, complicated prose because they think it is more likely to be published. (To find out more about Kirkman's surveys, see Bardell, 1978; Kirkman, 1992: Appendices A-F; Olsen & Huckin, 1991: 478-481). This notion that science writing must be 'impressively' dense seems to be inculcated at an early age (Box 3).

Box 3: How British scientists are taught to write?

[*New Scientist*] ...often despairs at the way scientists write their research papers. The prose often seems pompous, the meaning obscure. For some reason, many boffins don't seem to be able to resist using a long technical word when the simple everyday equivalent would do. We suspect that the problem may start in the schoolroom.

Recently, one of [our] colleagues asked her daughter how her physics lessons were going at school. 'I really like physics, and have no problems understanding it,' the daughter replied. 'But I often get a bad mark for my written work.

'Why?' the concerned mother asked. 'Well, the teacher doesn't like the way I write,' came the reply. 'For example, last week, when I was writing up an experiment, I put down: "The object moved to one side." The teacher said that I should have written "The object was displaced horizontally".'

The writing of L2 scientists

The paradox between how scientists *should* write in English and how they *actually* write affects L2 (i.e. second-language) scientist-authors too. In his workshops, Kirkman (pers. comm.) has found that the dichotomy between 'readable prose' and 'scientifically esteemed prose' is even more marked among them: when asked to indicate which style of scientific writing they find most readable, L2s show a strong preference for the simplest and most direct version of the set of texts they are offered, whereas L1s tend to find this too simple – yet both groups associate scientific credibility with a densely written, difficult style. Many L2s set out to acquire the skills of science writing by emulating the style of articles published in their field by L1 authors (Gosden, 1995; John , 1987 (Spanish scientists); Ventola, 1992 (German scientists); from my experience I know that this is also what Dutch scientists do) . As I explained above, this strategy is likely to provide them with examples that are not written in the ideal readable style championed by textbooks; it perpetuates the style of writing known pejoratively as 'scientific'.

It seems to me that this state of affairs could generate tension between English teachers and L2 scientists. Do the scientists ever feel that language teachers who are not scientists are attempting to teach them an idealised English that they do not see in the L1 texts they read to keep abreast of their field of research? L2s who feel this way are wanting to write as native speakers *do*, rather than as native speakers *should*. Ventola (1996) used the metaphor of a tightrope walker to describe the L2 scientist-author faced with this dilemma.

Yet even though L2s want to write like native speakers, they rarely manage to do so. They make learner mistakes. As they are eager to learn how to avoid these mistakes, they want to learn grammar, spelling, idiom. Teachers of English can help

here, but so, increasingly, can computer spelling and grammar checkers. Since many of these L2 mistakes are the easiest for human checkers to remove too, it is no surprise to find that science editors look leniently on them. This was one of the findings of Hugh Gosden, a teacher of English at the Tokyo Institute of Technology, who analysed the responses of 154 editors of English-language physics, chemistry and biology journals in the US, Canada and UK, whom he surveyed to ascertain the influence of certain aspects on the acceptance of L2-authored papers (Gosden, 1992). He reported that editors and referees do routinely correct obvious errors and infelicities ('simple sentence level errors') in L2 texts. This would confirm Janopoulos's (1992) finding that university teaching staff in science and technology were tolerant of errors in L2 writing. From this we may infer that superficial errors of English made by L2 authors are likely to be forgiven if the underlying science is good (see also Box 4); this suggests that L2 scientists can get away with less than perfect English.

Box 4: A journal editor's view of L2 English

What about those scientists for whom English is a foreign language? The answer is that in most instances they do well. Their English might have contained grammatical flaws, faults of syntax and colourful idiosyncrasies. But it was usually clear. The errors were readily corrected, and I am not one to suppress colour.

(Webster, 1990: 5, in his valedictory editorial for *Soil Use and Management*.)

As part of his survey, Gosden asked respondents to state the degree of influence (great, some, none) of 10 textual aspects on their assessment of the publishability of L2 manuscripts. The resulting ranking, shown in Box 5, indicates what features of written English L2 scientists should master in order to improve their chances of publication.

Box 5: Rank order of editors' (N=116) perceptions of influence on publishability of L2 research articles

(adapted from Gosden, 1992: Figure 1)

1. Logical and clear linking of sentences for the reader
2. Development of the topic from sentence to sentence in a coherent way
3. Use of grammatically correct sentences
4. Ability to manipulate skillfully the language used in making this claim
5. Appreciation of the level of claim that can justifiably be made for their research
6. Organisation of the different sections of the paper in a clear and logical way
7. Appreciation of the status of their work in the wider academic community and negotiating of this situation in subsequent correspondence with the editors
8. Ability to manipulate the language which reflects awareness of this status
9. Writing in the style of academic written English and not everyday spoken English
10. Use of a wide range of vocabulary

The low priority Gosden's respondents gave to writing in 'academic English' confirms that, whatever the text analyses of English science writing suggest, scientists who want to be published *in English* should not try to make their style 'impressive'. They should aim to write the readable English advocated by textbooks on scientific writing.

Gosden's editors rank the ability to write grammatically correct sentences highly (third), but this must be set against their (and their referees') willingness and ability to correct superficial errors, which was mentioned above. We may infer that a text that is ungrammatical isn't necessarily difficult to read – at least, not for an English native speaker screening the manuscript for publishability. And, in the case of international English-language journals it is this reader who our L2 scientists must effectively communicate with. So it is therefore interesting to note that Gosden's editors attach great importance to the need for cohesion and coherence; it indicates that these features are crucial to readability and moves our focus from skill in writing English sentences to skill in writing 'logical' series of sentences to form text units: paragraphs, sections – even chapters. We have moved up a level, into a consideration of discourse, and here an author's writing technique, background language and culture are important.

The role of culture in writing

Since Halliday and Hasan's seminal work on the importance of cohesion and coherence in written English (1976) there have been many studies reporting on shortcomings in cohesion and coherence in L2 and unskilled L1 texts. Here, I should perhaps point out that cohesion is a quantitatively expressible aspect of coherence: in English, it can be measured by the incidence of cohesive devices or 'connectors' deployed to signal how successive sentences are linked in the discourse. Coherence is also achieved by developing a topic in a series of sentences in a way that the reader finds logical. What is 'logical' varies with language and culture and has to do with where the topic of the sentence is placed (up front, or at the end) and how the elaborations of the topic follow in the subsequent sentences (see Mauranen, 1996). At paragraph level, this development of the topic may proceed from the general to the specific (the deductive style of writing) or vice versa (the inductive style).

All writers have a preferred sentence form (syntax) in their native language (in English: subject, verb, object) and an accepted way of focusing the sentence (in English, at the end) but have to learn how best to use these characteristics and the appropriate cohesive devices when writing. In other words, cohesion and coherence are not intuitive to writers, but have to be learned; hence the advice for English native speakers contained in Flower, 1981: 239-247; Day, 1995: 69-71; also Dudley-Evans, 1991, describing the text improvements made by a supervisor to a PhD thesis in biology).

So, if novice L1 writers have to learn the techniques for writing cohesively and coherently in their mother tongue, it should be no surprise to find L2 authors having difficulty in mastering these features in a second language. Various studies have provided evidence of L2 shortcomings in these aspects in relation to writing in science and technology. Parsons (1991) has presented quantitative (based on text analysis) and qualitative (readers 'assessment) evidence for L2 writing of engineering postgraduates being less coherent than that of L1 peers. (His L2s were Algerian.) Ventola (1994) looked at German and English abstracts for medical journals written by four established scientists (*not* students). She shows that they used fewer

connectives and other cohesive devices in the English versions of their abstracts and that because of the way they structured their English sentences, their topic development was not successful. The result was that their texts were reader-unfriendly: they advanced 'jerkily' whereas their German texts advanced 'flowingly'. Even though these scientists had attempted to modify their writing to the English 'ideal' by trying to shorten their sentences, their texts were demonstrably different from native-speaker texts. In an earlier study, Ventola (1992) had shown that the written English of Finnish scientist-writers contains fewer connectors than comparable texts written by English native speakers.

The differences reported in the studies mentioned above cannot be attributed to the writers being inexperienced: all the subjects examined were at least postgraduates. Their imperfect command of English might account for some of the ways their texts failed to meet English norms of cohesion and coherence, but I believe they are also constrained by *how far they think they need to go*. I would argue that in the case of mature professionals having to write in a second language, conventions in their own writing culture can (subconsciously) prevail. In other words, and keeping with the example of cohesion and coherence, L2 authors may be subliminally prevented from using cohesion to the same extent as an English native speaker because they feel they have achieved cohesion and coherence in accordance with the norms of scientific discourse in their native language. If they remain unaware that the template for (science) writing in their native language differs from the template for their second language, they are going to end up with structural problems in their L2 writing. And a combination of learner errors *and* inappropriate structure is too much for most journal editors and referees to handle: this too is clear from Gosden's (1992) survey and from Webster's comments (Webster, 1990; Webster & Oliver, 1993).

Fortunately, there is a growing body of evidence to convince these L2s – and their English teachers - that there are cultural differences in the writing of science and that these need to be taken into account when writing science in a second language (for reviews see Connor, 1996; Grabe and Kaplan, 1996; for Eastern European evidence see Duszak, 1997; Ventola and Mauranen, 1996). A more useful approach, however, is not to compare and contrast the L2 English with L1 English, but to look at the writing style and conventions in the L2 author's native language and compare these with English. This reveals possible sources of inappropriate transfer (see also Kellerman, 1995). Once you know these, you can develop an appropriate avoiding strategy for writing successfully in English!

Dutch scientist-authors and English norms in scientific writing

To illustrate how writing conventions may be unwittingly transferred from the author's culture to English, let us look at scientists whose native language is Dutch. My comparison of Dutch and English science writing is not finished, but I would like to show you some preliminary attempts to identify similarities and differences. Box 6 shows the first paragraph of Dutch and English versions of the summary of a thesis, both written by a Dutch PhD candidate (aged 39) with a good publication record. It is important to note that what we have here is a text by a mature Dutch scientist, which her Dutch supervisors found acceptable. In accordance with usual practice in the Netherlands, this thesis was published after it had been read by the examiners and before the candidate had undergone the mandatory one-hour public defence.

Box 6: Dutch and English versions of summary of PhD thesis

(Written in 1993. Author a 39-year old statistician, with a Dutch degree and an MSc from a UK university and a number of publications in scientific journals to her name)

Dutch	**English**
Als gevolg van menselijk handelen komen een groot aantal chemische verbindingen in het milieu terecht. Ze worden via lucht, water en bodem getransporteerd en so over milieucompartimenten verspreid. Organismen komen daardoor in aanraking met verbindingen van een ongekende diversiteit en hoeveelheid. De ecotoxicologie bestudeert de effecten van het vrijkomen van chemische stoffen op ecosystemen. Eén van de hulpmiddelen die ecotoxicologen voor hun onderzoek gebruiken zijn ecotoxiciteitstoetsen. Met deze laboratorium-experimenten schat men de relatie tussen de concentraties waaran organismen worden blootgesteld en de aard en omvang van de effecten. Ecotoxiciteitstoetsen hebben dus betrekking op de laatste stap in de keten 'uitstoot, transport, blootstelling en effect'. De toetsen spelen een belangrijke rol in onderzoek en beleid met betrekking tot toxische stoffen, mede doordat de experimenten relatief eenvoudig zijn uit te voeren.	Large amounts of chemicals find their way into the environment as a result of human activities. They are transported via air, water and soil and distributed over environmental compartments. Consequently, organisms are challenged by chemical compounds in a variety and at intensities unknown in the past. Ecotoxicology is the science that studies the ecotoxicological effects of the release of chemicals. One of the tools that ecotoxicologists use for their research is the single species ecotoxicity test. With this laboratory experiment the relation can be studied between concentrations to which organisms are exposed and the nature and magnitude of the effects. Hence ecotoxicity tests relate to the last step in the causal chain 'emission, transport, exposure and effect'. The tests play an important role in research and government policy with respect to toxic substances, not in the least because the tests are relatively simple to carry out.
No. of words: 128 (incl. 2 closed compounds and 1 hyphenated compound) *No. of sentences: 8* *Mean sentence length: 16 words*	*No. of words: 145* *No. of sentences: 8* *Mean sentence length: 18.1 words*

As is often the case, the English version of the summary is a faithful sentence-by-sentence rendering of the Dutch. We can assume that the Dutch version is acceptable to Dutch readers, but the English version does not read like a native-speaker text. Correcting the grammatical mistakes won't solve the problem. Why? One reason is that there are too few connectors and cohesive devices for the text to flow as it should in English. Another is that the sentences appear to be short in English (lack of relative clauses). A third reason is the mismatch between Dutch and English conventions about where the focus of the sentence should lie for maximum

impact. In Dutch, the focus is at the beginning; in English, it's at the end (see also Hannay and Mackenzie, 1996). The author has made the necessary adjustment of word order in English in the first sentence, but not in the fourth; this failure to adjust sentence focus contributes to the abruptness of the fourth sentence. It is these transfers of Dutch writing convention that make this text unsuccessful in English - even though one of its 'Dutch' attributes – short sentences – is advocated for successful English science writing.

There is analytical evidence for this difference in the characteristics of Dutch and English writing in other genres. Hannay's (1997) analysis of comparable argued (feature articles in newspapers) and persuasive texts (letters asking for donations to charities) written in Dutch and in English has revealed that there is a significant and measurable difference between the two written languages today: Dutch sentences are shorter (the use of incomplete sentences is also a characteristic) and chunks of text contain fewer overt connectors. Hannay notes that, as a result, written Dutch is closer to the spoken language; he contrasts it with written English, which, by being more contrived, is further from its spoken counterpart. (Though this may soon change as more L1English authors switch to using voice recognition systems to write their articles.) Thus, Dutch authors will tend to use a 'chopping' (Hannay's term) style in whatever language they write.

Once you are aware of the difference between discourse convention in Dutch and English, it becomes clear why Dutch authors find it difficult to write as they *should* in English: they can only do so by consciously changing their discourse template. They have to realise that writing successfully in English is more than writing a series of sentences that are individually grammatically correct: they must learn to provide more overt links between sentences than they do when they write in their mother tongue.

Box 7: A Dutch-style MSc summary?

The affect of assimilate availability on the dynamics of fruit set and dry matter distribution of sweet pepper was studied. The experiment was carried out in a
greenhouse from January 10th to July 2nd, 1996. The assimilate supply was varied by means of three plant densities (4.63, 3.12 and 1. 56 pl m^{-2}). The measurement were used for validation of a general simulation model for greenhouse crops (HORTISIM). The model was validated on dry matter production and dry matter distribution. Moreover, a submodel for fruit set/abortion of greenhouse sweet pepper was developed. The dry matter production per m^2, total fruit yield per m^2 fruit growth period, LAI and SLA increased with plant density. The fraction of dry matter partitioned to the fruits, number of fruits set per plant, early fruit yield per m^2 fruit size, fraction of fruits affected by blossom end rot, and leaves and stem dry matter content decreased with plant density. The leaf area per plant, number of leaves per plant and distribution between leaves and stems were not affected by plant density. The cumulative fraction partitioned to the fruits showed a sigmoid type of relationship with the cumulative number of fruits per plant independent of plant density. The production of harvestable fruits per week showed clear fluctuations in time due to similar fluctuations in fruit set. The observed fluctuations were synchronized for the highest and intermediate density. But not for the lowest density, which had earlier production of harvestable fruits per week…

Mean sentence length: 11 words

Box 7 is an extract from the summary of an MSc thesis. I present it to reinforce my contention about the writing style preferred by Dutch scientists. But in this case, the author's native language is not Dutch – it's Spanish! What has happened is that the Dutch supervisor has 'improved' the Spanish-English. I encountered this tweaking of language from one L2 form to another in various MSc theses submitted in English to Wageningen Agricultural University (the most international Dutch university) by Spanish speakers. Various Dutch supervisors had told me that they found Spanish English too long-winded and that they had helped their students to make their writing 'more acceptable'. The result is that the 'elaborate' rhetoric of the Spanish-authored English (see Connor, 1996: 52-53; Grabe and Kaplan, 1996: 194-195) of the MSc theses has been converted into strongly deductive writing, short sentences, relatively little modality and few overt connectors. Unfortunately, on a scale of discourse and rhetoric types, though the Spanish model is too elaborate for English scientific writing, the Dutch model is too blunt and choppy. The Dutch improvements have gone too far.

Recognising and reconciling writing cultures

Learning to appreciate discourse templates in the source and target languages and to apply the appropriate template while translating is what good translators do, in order to achieve a translation that functions optimally in the target language and culture. Scientists who write in two languages should do likewise. At the very least they can and should learn which conventions must not be transferred indiscriminately from their writing culture to English. To return to the example of Dutch scientists: the perfectly acceptable convention in Dutch of reporting past events in the present tense cannot be allowed in English, because in that language it transmits the signal that the events mentioned are general truths. Furthermore, the Dutch conventions regarding the use of various Latin words and phrases in academic writing (such as *idem*, *ad*, *i.c.*), abbreviations (f.i., a.o.) and symbols – notably the ± – are not permissible in English.* Computer software doesn't always challenge these types of error, and neither do journal reviewers always specify why they have queried them, circled them or deleted them. Furthermore, as standard textbooks on writing scientific English do not and cannot deal with culture-specific idiosyncrasies like these, there is a risk that L2 authors will remain oblivious to them for some time.

I have argued that L2 scientists should go as far as they can towards writing readable English like *ideal* L1 scientists, because the editors of prestigious English-language scientific journals will then look more favourably on their submissions. As I noted above, this does not necessarily mean that no learner-English mistakes will be tolerated, but it does mean that L2s should consciously avoid features that are unknown or less acceptable in English science writing. More importantly, L2 authors should adjust the rhetoric of their English writing so that it does not clash with English norms in science writing. To do so, your Spanish authors and my Dutch authors will have to converge on English from different directions: the Spanish speakers will have to move their writing style from elaborate towards simple and the

* In Dutch, *idem* is used where English would use *ditto*; *ad* is used where English would use 're'; *i.c.* = *in casu*, used to mean 'in the case of'; f.i. = for instance; a.o. = among others; and ± is used to mean 'approximately'. For other differences between Dutch and English conventions in writing, see Burrough-Boenisch, 1998.)

Dutch from simple towards elaborate. I suspect that the Dutch scientists will be at an advantage, because referees and editors of English-language scientific journals probably find that texts built up from 'simple', short Dutch-style sentences are more readable than texts that feature complex, elaborate Spanish-style writing. It seems highly likely that scientists can adjust their style more easily if they are aware of how their writing culture is positioned relative to English. English teachers and editors can help them by explaining the features of the two writing cultures and suggesting the best strategy for converting from one to another.

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